Climate related emissions:
What about Kigali and net zero for RACHP

Lambert Kuijpers
A/gent b.v. Consultancy – (TEAP-RTOC)
(presentation done in a private capacity)

Outline

- Introduction

  Refrigeration systems – global development
- Implementation of the Kigali Amendment
- Energy Efficiency and the Kigali Amendment
- (The race to) Net zero by 2050
- Concluding remarks

RACHP systems – global development

Non-Article 5 countries

- Moderate growth in numbers (AC, various parts of the cold chain)
- Conversion from HFC to low-GWP (naturals, HFOs, HFC-HFO mixtures) (HFC-32 will be accepted for a number of years)
- Further energy efficiency improvement of system operation
- Use of renewable energy (mainly electricity)

Article 5 countries

- Large growth in numbers forecast (particularly AC, also cold chain parts)
- Energy efficiency improvement of components and systems needed
- MEPS and other efficiency regulations underway
- Much fossil based energy production (and still growing)

RACHP uses 20% of electricity production globally – percentage will increase

Implementation of the Kigali Amendment

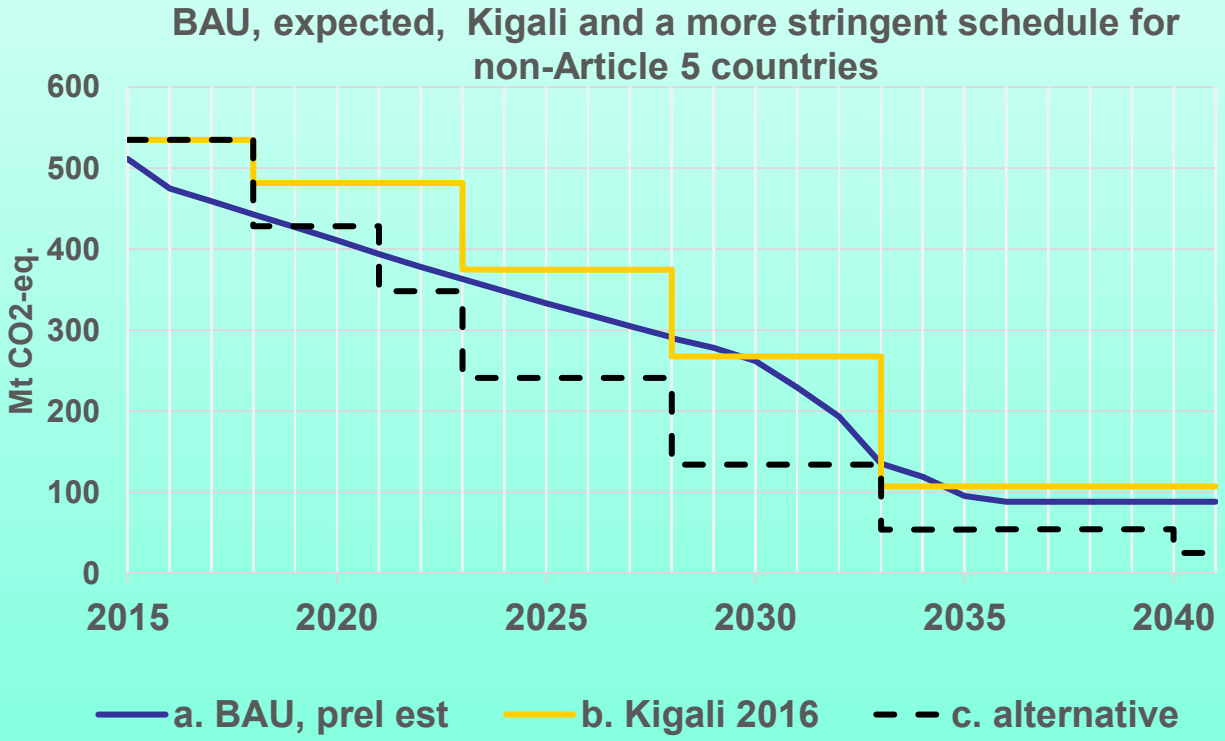
- Kigali is an HFC production - consumption "compliance regime"
- RACHP is responsible for about 805 of the total HFC consumption
- Kigali does not deal with HFC emissions or with emissions related to energy use - of course, the purpose is to *decrease HFC emissions*

- Kigali has been ratified by 116 countries (incl. the EU/EC); large developing countries and some developed have not (yet) ratified
- Developed countries (that ratified) have to follow a **phase-down** schedule to 15% of baseline consumption/production by 2036
- Developing countries (groups 1 and 2) still have to establish their baselines - their freeze level will then "start" in 2024 or 2028

The Kigali Amendment as such

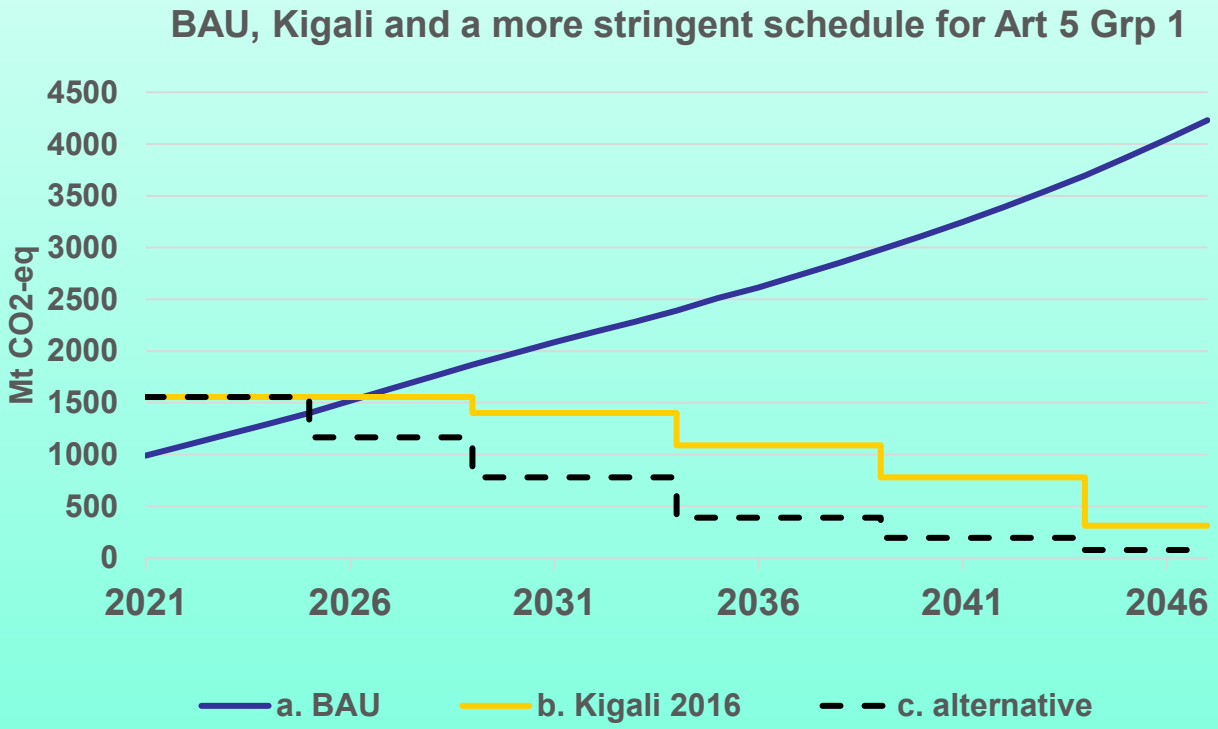
- There are voices that Kigali is not ambitious enough and would need strengthening, which is, in fact, a bit premature
- However, with not all developed countries having ratified Kigali at present, and with the baselines not yet established for the developing countries, any negotiations to strengthen Kigali would be too early
- Furthermore, the Multilateral Fund has not even agreed on guidance and strict guidelines for developing country HFC phase-down funding
- *Nevertheless, as an example, the following two slides show how a possible strengthening of the schedules could look like (a more stringent schedule up to 2035 and a phase-out after 2050) which will result in climate benefits up to 2050 and for 2050-2100*

The Kigali Amendment – possible strengthening, non-Article 5



Climate benefits: (Kigali vs. alternative) **2021-50: 3520 $MtCO_2eq$.** (Kigali vs. alternative) **2050-2100: 5340 $MtCO_2eq$.**

The Kigali Amendment – possible strengthening, Article 5



Climate benefits: (Kigali vs. alternative) **2021-50: 14240 $MtCO_2eq$.** (Kigali vs. alternative) **2050-2100: 15550 $MtCO_2eq$.**

Kigali and energy efficiency

- To repeat, the Kigali Amendment is a consumption and production "compliance regime", it cannot be an emissions part of the Protocol

  Note: The Montreal Protocol is no emissions "regime"
- In the Kigali Amendment there is Dec XXVIII/2, para 22, that mentions the "maintaining or enhancing energy efficiency in HFC conversion projects", with has no direct linkage to the Kigali Amendment, it is related to Multilateral Fund funding for certain projects
- This deals with not impacting the energy efficiency level in manufacturing conversions, and the funding considerations that would then apply (nothing is related here to "*energy efficiency overall")*
- So, the link that is often made to energy efficiency is an extra "constructed" one, not part of the Protocol (as far as it is now)

Kigali and energy efficiency

- Energy efficiency as such is not part of the Kigali phase-down; energy efficiency improvement of equipment can therefore not be considered as a funding element for Article 5 countries
- K-CEP (Kigali Cooling Efficiency Program) originally linked efforts in relation to energy efficiency with a simultaneous HFC phase-down; it is possible, of course, but would require efforts and funding separate from the Montreal Protocol; K-CEP has invested funds in various non-investment activities related to energy efficiency
- One has also come to the conclusion that demand reduction (together with energy consumption decrease of equipment) will be the essential, main issue for the near future (towards 2050)
- This will work out on emissions

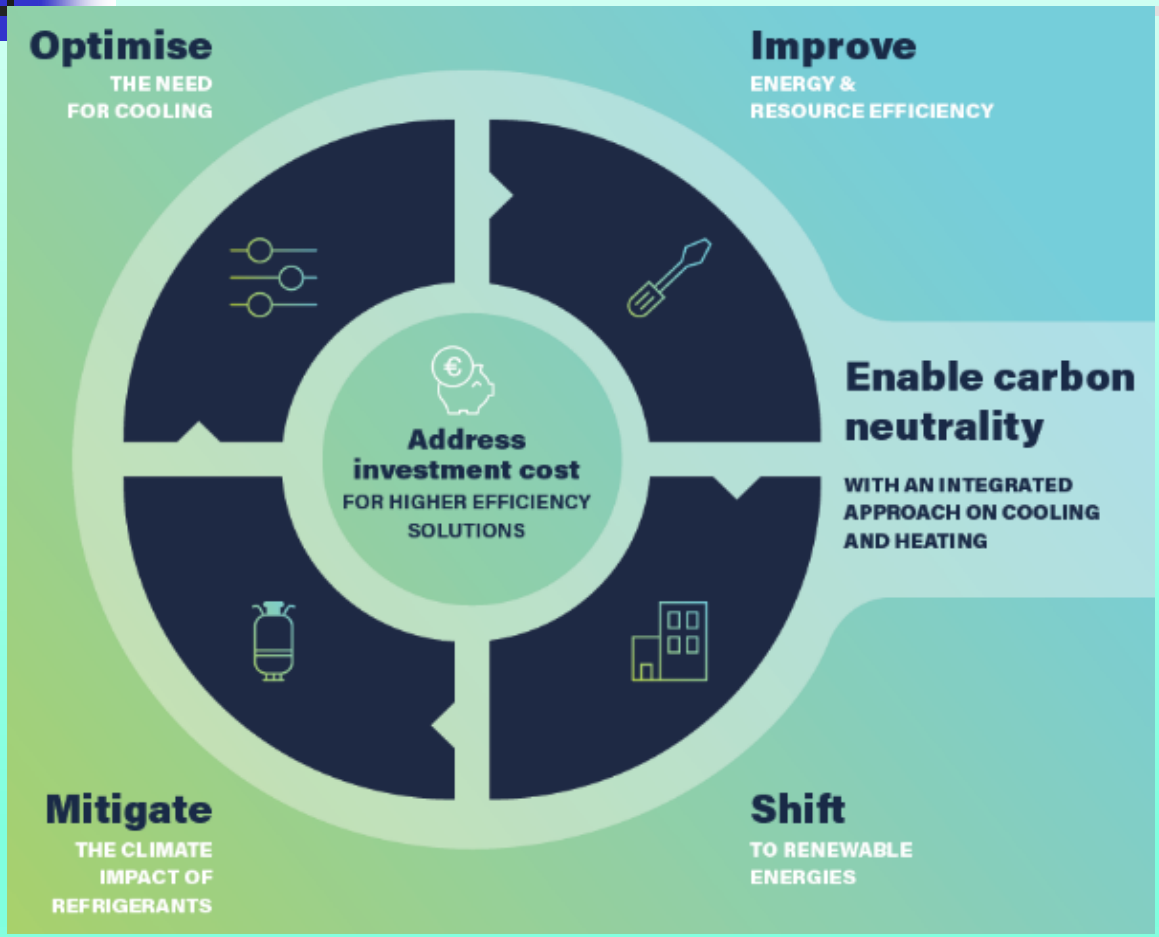
The race to net zero

- Far more important than only the HFC phase-down is the current "strategy" to achieve a net-zero (carbon emissions) target by 2050
- Net-zero means "carbon neutrality by 2050" *(whether this also applies to all other GHGs has not been clearly defined yet)*
- To achieve carbon neutrality by just using renewables in all sectors (not only RACHP) will be a huge task, and will ask for an enormous growth in global renewable capacity, realisation of which is "questionable"
- Carbon neutrality should be achieved by demand reduction, by better system performance (including the application of storage and other means) **AND** then the use of renewables should do the rest (!)
- Plans are underway that discuss a 50% emission reduction by 2030, followed by further steps in the two decades thereafter (net-CO_2)

The EPEE and IOR proposals

Both the EPEE (European Partnership for the Energy and Environment) and the IOR (institute of Refrigeration, UK) have proposed a number of elements necessary for achieving a “net zero” by 2050 for the RACHP sector

The EPEE proposal



The IOR proposal

Common elements in these proposals

Two major items are important here:

(1) *reducing electricity consumption via maximizing performance and reducing demand as much as possible, and*

(2) *plan in such a way that renewables will become a large (in some cases the only) part of the electricity provided in future*

- There is a link between (1) and (2), where (1) must have highest priority, and (2) complements the whole for the "race to net-zero" path

Net zero solutions

- In summary, any “good” solution to the challenge of addressing “net-zero” by 2050 is very much related to how one can and will deal with the input of renewable energy as the contributor to the total.
- Systems cannot just rely on renewables, but have to build in system complexity to reduce or flatten demand, via e.g., storage, co-generation, new efficient methods etc.
- And this also implies that all elements should *(actually)* be directly related to a sustainable financing system that would be coherent with implementing those sustainable, renewable energy changes.
- This are all major issues to be dealt with *"now",* to be done so promptly during this decade, when clear trends have to be set towards 2050 !!

On net zero in relation to Kigali HFCs

- A reduction in the consumption of HFCs following Kigali contributes to low (10-15% of baseline) HFC consumption after 2035-2040, it is not a phase-out *(emissions are a slightly different issue!)*
- The choice between low GWP refrigerants such as ammonia, CO_2, HCs and a number of HFOs -for HFCs- is something that enables ways and means towards environmentally responsible refrigerant use, while minimising energy consumption (even when this is (mainly) application related)
- Applying these refrigerants will result in further optimisation possibilities, an important role that these refrigerants in equipment can play towards the "net-zero" target, but it will be equipment related

Concluding remarks

- A large growth in numbers is forecast (particularly AC, also cold chain parts) for Article 5 countries
- Kigali does not deal with HFC emissions or with emissions related to energy use - of course, the purpose is to *decrease HFC emissions*
- More stringent scenarios can give an impression what could be possible
- Energy efficiency as such is not part of the Kigali phase-down; energy efficiency improvement of equipment is to be considered "extra"
- Far more important than only the HFC phase-down is the current "strategy" to achieve a net-zero (carbon emissions) target by 2050
- Any "good" solution to the challenge of addressing "net-zero" by 2050 is related to how one will deal with renewable energy input in the total
- Applying low GWP refrigerants will result in optimisation, but it will be equipment and "structure" related

Thank you !!